Deacon's Challenge

No 158 - Answer

Your laboratory is considering a change in creatinine method from a kinetic Jaffe to an enzymatic method. You are provided with the results obtained on a serum sample from a patient in Intensive Care, using the new method and your current method. Assess the probability of an interfering substance being present in this specimen.

Results: Creatinine	*(Jaffe)*	*157 mmol/L*
	(enzymatic)	*172 mmol/L*
Analytical CV:	*(Jaffe)*	*3.0%*
	(enzymatic)	*2.3%*
Regression equation:	*Jaffe = 0.9539 (enzymatic) + 11.375*	

Table of z-distribution:	*P(%)*	*10*	*5*	*2*	*1*	*0.2*	*0.1*
	z	*1.65*	*1.96*	*2.33*	*2.58*	*3.09*	*3.29*

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First convert the actual Jaffe result into the *expected* enzymatic result using the regression equation relating the two methods:

157 = 0.9539 (enzymatic) + 11.375

0.9539 (enzymatic) = 157 - 11.375 = 145.625

Expected enzymatic = $\frac{145.625}{0.9539}$ = 153 µmol/L (to 3 sig figs)

Next calculate the standard deviations for both actual and expected enzymatic results from these results and their analytical CVs:

Actual enzymatic SD = $\frac{2.3 \times 172}{100}$ = 3.96 µmol/L (to 3 sig figs)

Expected enzymatic SD = $\frac{3.0 \times 153}{100}$ = 4.59 µmol/L

The difference between the actual and expected enzymatic results would be expected to be normally distributed with a SD equal to their combined SD. If there was no significant difference between the two results (i.e. the difference was due simply to the analytical variation of the two methods) then the mean of the distribution would be zero. Therefore we need to calculate a *z*-score for the difference between the two values and compare it with zero:

z score = $\frac{0 - (\text{actual enzymatic result} - \text{expected enzymatic result})}{\text{Combined SD}}$

When two results are added or subtracted their combined SD is equal to the square root of the sum of their squared individual SDs:

Combined SD = $\sqrt{(3.96^2 + 4.59^2)}$

= $\sqrt{(15.68 + 21.07)}$

= $\sqrt{36.75}$

= 6.06 µmol/L (to 3 sig figs)

Therefore $z = \frac{172 - 153}{6.06}$ = **3.14**

From tables of *z* the probability that the difference between the two results could have arisen by chance if there was no real difference between them is between 0.001 and 0.002. Therefore it is very likely that an interfering substance is present in the specimen that was not present in the samples used to derive the regression equation, or is present at a much higher concentration.

Question 159

Calculate the expected pH of an aqueous 0.25 % w/v solution of sodium lactate. (The pKa of lactic acid is 3.86 and the atomic weights are C = 12, H =1, O = 16 and Na = 23.